

# INTERNET COOPERATION TREA

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner  
US Department of Commerce  
United States Patent and Trademark  
Office, PCT  
2011 South Clark Place Room  
CP2/5C24  
Arlington, VA 22202  
ETATS-UNIS D'AMERIQUE  
in its capacity as elected Office

Date of mailing (day/month/year) 04 December 2000 (04.12.00)	
International application No. PCT/NL00/00227	Applicant's or agent's file reference BO 42487 AS
International filing date (day/month/year) 06 April 2000 (06.04.00)	Priority date (day/month/year) 06 April 1999 (06.04.99)
Applicant KAPAAN, Hendrikus, Jan-et-al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:  
03 November 2000 (03.11.00)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was  
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Zakaria EL KHODARY Telephone No.: (41-22) 338.83.38
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09/937, 7+6

PATENT COOPERATION TREATY

PCT

REC'D 21 MAY 2001


WIPO

PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

14

Applicant's or agent's file reference BO 42487 Web		<b>FOR FURTHER ACTION</b>	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/NL00/00227	International filing date (day/month/year) 06/04/2000	Priority date (day/month/year) 06/04/1999	
International Patent Classification (IPC) or national classification and IPC F16H25/22			
Applicant SKF ENGINEERING & RESEARCH CENTRE B.V. et al.			
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 5 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 5 sheets.</p>			
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"><li>I <input checked="" type="checkbox"/> Basis of the report</li><li>II <input type="checkbox"/> Priority</li><li>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</li><li>IV <input type="checkbox"/> Lack of unity of invention</li><li>V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</li><li>VI <input type="checkbox"/> Certain documents cited</li><li>VII <input checked="" type="checkbox"/> Certain defects in the international application</li><li>VIII <input type="checkbox"/> Certain observations on the international application</li></ul>			
Date of submission of the demand  03/11/2000		Date of completion of this report  17.05.2001	
Name and mailing address of the international preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465		Authorized officer  E.J. Stierman  Telephone No. +49 89 2399 8883	



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/NL00/00227

**I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

**Description, pages:**

1-5 as originally filed

**Claims, No.:**

1-15 as received on 06/04/2001 with letter of 06/04/2001

**Drawings, sheets:**

1/2,2/2 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☒ the claims, Nos.: 16-33

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/NL00/00227

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

## V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

### 1. Statement

Novelty (N)	Yes: Claims 1-15
	No: Claims
Inventive step (IS)	Yes: Claims 1-15
	No: Claims
Industrial applicability (IA)	Yes: Claims 1-15
	No: Claims

2. Citations and explanations  
**see separate sheet**

## VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:  
**see separate sheet**

Reference is made to the following document:

D1: DE 19736503

**Re Item V**

**Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

The invention relates to an actuator to convert a rotary movement into a linear translation comprising a housing, a motor, a screw and nut mechanism and a gear reduction mechanism.

A similar actuator is known from D1.

It is an object of the invention to design an actuator with compact dimensions.

This object is according to the characterizing portion of claim 1 solved in that the gear ring of the reduction mechanism is integrated with the screw of the screw and nut mechanism. (In D1 the gear ring of the reduction mechanism is integrally connected to the nut instead of to the screw. Although the invention seems a trivial alternative constructional measure, it cannot be derived from D1 because it would also involve an alternative construction of non-rotatably connecting the nut to the housing.)

Hence, this alternative is neither known from, nor rendered obvious by the available prior art. The subject-matter of claim 1 is therefore new and inventive; claim 1 fulfills the requirements of Article 33 PCT. Claims 2-15 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/NL00/00227

**Re Item VII**

**Certain defects in the international application**

Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the document D1 is not mentioned in the description, nor is this document identified therein.

The description is not in conformity with the claims as required by Rule 5.1(a)(iii) PCT. In particular, the embodiment of figure 3 does not form part of the invention.

(75)

Claims

1. Actuator, comprising a housing (1), which contains a motor (2) and a screw  
5 mechanism (3), said screw mechanism (3) comprising a screw (16) and a nut (17) one  
of which is rotatably supported with respect to the housing (1), and a gear reduction  
mechanism (4) connecting the rotor (7) of the motor (2) to the rotatable screw (16) or  
nut (17), said gear reduction mechanism (4) comprising at least a concentric gear ring  
10 (25) with radially inwardly directed teeth, an eccentrically positioned gear wheel (24)  
having radially outwardly directed teeth wherein the outer diameter of the gear wheel  
(24) is smaller than the inner diameter of the gear ring (25), such that the teeth of said  
gear wheel (24) and gear ring (25) engage each other along a part of their  
circumferences, and at an opposite part of their circumferences are out of engagement,  
said eccentric gear wheel (24) being rotatable accommodated on an eccentric hub (23)  
15 which is connected to the rotor (7) of the motor (2), characterised in that the gear ring  
(25) is integrated with the screw (16) of the screw mechanism (3), said screw (16)  
being rotatably supported with relation to the housing (1).

6<sup>a</sup>Claims

1. Actuator, comprising a housing (1), which contains a motor (2) and a screw mechanism (3), said screw mechanism (3) comprising a screw (16) and a nut (17) one of which is rotatably supported with respect to the housing (1), and a gear reduction mechanism (4) connecting the rotor (7) of the motor (2) to the rotatable screw (16) or nut (17), characterized in that the gear reduction mechanism (4) comprises at least a concentric gear ring (25) with radially inwardly directed teeth, an eccentrically positioned gear wheel (24) having radially outwardly directed teeth wherein the outer diameter of the gear wheel (24) is smaller than the inner diameter of the gear ring (25), such that the teeth of said gear wheel (24) and gear ring (25) engage each other along a part of their circumferences, and at an opposite part of their circumferences are out of engagement, said eccentric gear wheel (24) being rotatably accommodated on an eccentric hub (23) which is connected to the rotor (7) of the motor (2).
2. Actuator according to claim 1, wherein the gear ring (25) is integrated with the screw (16) of the screw mechanism (3), said screw (16) being rotatably supported with relation to the housing (1).
3. Actuator according to claim 1 ~~or 2~~, wherein the rotor (7) of the motor (2) is rotatably supported on the outer ring (10) of a support bearing (11), said outer ring (10) being integrated with the screw (16) and the gear ring (25).
4. Actuator according to claim 3, wherein the rotor (7) by means of a radially inwardly extending flange (21) is connected to the eccentric hub (23).
5. Actuator according to claim 4, wherein a positive back-drive mechanism (30) is connected to the flange (21) and the housing (1).
6. Actuator according to claim 5, wherein the positive back-drive mechanism is a spiral spring (30).
7. Actuator according to any of the preceding claims, wherein the eccentric gear



wheel (24) is rotatably supported with respect to the excentric hub (23) by means of a rolling element bearing (30).

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8. Actuator according to any of the preceding claims, wherein the motor (2) is an electric motor, the stator (6) of which is connected to the housing (1).

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9. Actuator according to any of the preceding claims, wherein the gear reduction mechanism (4) is at the end of the screw mechanism (3) opposite the end thereof engaging an actuating means (38) for a brake pad (39).

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10. Actuator according to any of the preceding claims, wherein the screw (16) of the screw mechanism (3) is rotatably supported by means of a support bearing (11) with respect to a central support shaft (13), the gear ring (23) and the gear wheel (24) of the reduction gear mechanism (4) surrounding said central support shaft (13).

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11. Actuator according to any of the preceding claims, wherein the screw (16) has a bore (35) containing a lubricant reservoir (36).

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12. Actuator according to any of the preceding claims, wherein the gear reduction mechanism (4) and a positive back-drive mechanism (37) are contained in a gear reduction module (40).

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13. Actuator according to any of the preceding claims, wherein the gear reduction module (40) comprises a central support shaft (13) for supporting the screw mechanism (3).

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14. Actuator according to any of the preceding claims, wherein the screw mechanism (3), a support bearing (11) for supporting the screw mechanism (3), the rotor (7) of the motor (2) as well as a bearing (9) for supporting the rotor (7) on the screw mechanism (3) are contained in a actuator module (41).

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15. Actuator according to any of the preceding claims, wherein the housing (1),

the stator (6) and electric connections for the motor (2) are contained in a housing module (42).

16. Actuator according to one claim 1, comprising a housing (55), a nut (55) and a screw (56) one of which is axially fixed with respect to the housing (51) and the other of which is axially displaceable with respect to the housing (51) for moving an actuating head (71), as well as a motor (57) which comprises a stator (58) connected to the housing (51), and a rotor which is drivingly connected to a rotatable part (56) of the screw actuator (54), the housing (51) having a bore (60) accommodating at least the nut (55) and/or screw (56), an axially fixed part (55) of said nut (55) or screw (56) being supported with respect to a radial support abutment (61) which extends inwardly in the bore (60), wherein the rotor (59) of the motor (57) supported rotatably on a sleeve (63), said sleeve (63) engaging the fixed part (55) and extending away from the actuating head (71), said sleeve (63) having a radially outwardly extending sleeve flange (64) which is interposed between said support abutment (61), and the axially fixed part (55).

17. Actuator according to claim 16, wherein the flange (54) of the sleeve (63) is supported on an abutment surface (62) of the support abutment (61) which faces an actuating head (71) connected to the axially displaceable nut (55) or screw (56) for exerting a compressive force.

18. Actuator according to claim 16 or 17, wherein the nut (55) is fixedly supported within the housing (51), said nut (55) having a radially outwardly extending nut flange (65) facing the outwardly extending sleeve flange (64) and overlapping the inwardly extending support abutment (61).

19. Actuator according to claim 18, wherein the outwardly facing surfaces of sleeve flange (14) and the nut flange are curved in axial cross section, so as to allow swivelling or tilting of said nut and sleeve due to misalignment forces.

20. Actuator according to claim 18 or 19, wherein the nut (55) has a nut extension (66) extending beyond the nut flange (65) and inside the support abutment (61), the sleeve (63) having an axially extending support part (67) which is accommodated between said nut extension (66) and the support abutment (61).

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31. Actuator according to claim 30, wherein the gear wheel mechanism (4) is connected to a central drive shaft (76) which is rotatably supported in the housing (51) and which extends into a bore (77) in the screw (76), said drive shaft (76) being non-rotatably coupled to the screw (56) through a spline/groove mechanism.

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32. Actuator according to claim 31, wherein a lubricant dosing module (79) is accommodated in the bore (60) of the screw (66).

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33. Brake calliper, comprising a claw piece with at least two brakes, and an  
10 actuator according to any of the preceding claims.

# PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>BO 42487 AS</b>	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. <b>PCT/NL 00/ 00227</b>	International filing date (day/month/year) <b>06/04/2000</b>	(Earliest) Priority Date (day/month/year) <b>06/04/1999</b>
Applicant  <b>SKF ENGINEERING &amp; RESEARCH CENTRE B.V. et al.</b>		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.



It is also accompanied by a copy of each prior art document cited in this report.

**1. Basis of the report**

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.



the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :



contained in the international application in written form.



filed together with the international application in computer readable form.



furnished subsequently to this Authority in written form.



furnished subsequently to this Authority in computer readable form.



the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.



the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,



the text is approved as submitted by the applicant.



the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,



the text is approved as submitted by the applicant.



the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.



as suggested by the applicant.



because the applicant failed to suggest a figure.



because this figure better characterizes the invention.

1



None of the figures.

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/NL 00/ 00227

## Box III TEXT OF THE ABSTRACT (Continuation of item 5 of the first sheet)

The abstract is modified as follows:

A screw actuator comprises a housing "(1)", a nut "(A)" and a screw "(16)" one of which is axially fixed with respect to the housing and the other of which is axially displaceable with respect to the housing for moving an actuating head, as well as a motor "(2)" which comprises a stator "(6)" connected to the housing, and a rotor "(7)". The rotor "(7)" of the motor is supported rotatably on a sleeve "(8)", said sleeve has an inwardly directed flange "(21)", which carries an excentric hub "(23)". The excentric hub "(23)" rotatably supports a gear wheel "(24)" through bearing "(30)", the outer teeth of which gear wheel "(24)" engage the inwardly directed teeth of the ring gear "(25)". The ring gear "(25)" is driving screw "(16)" which is rotatably supported in the housing "(1)". The nut "(17)" of the screw mechanism "(4)" is slidably, but not rotatably with respect to the housing. Through the screwthreads "(18,19)" and balls "(20)", the rotary motion of the screw "(16)" is converted into a linear motion of the nut "(17)", which is contained in a cylinder space "(32)" in the housing "(1)".

## INTERNATIONAL SEARCH REPORT

National Application No

PCT/NL 00/00227

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 F16H25/22 F16D65/21 F16D65/16

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 F16H F16D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 197 36 503 A (SCHAEFFLER WAEZLAGER OHG) 25 February 1999 (1999-02-25)	1, 2, 7-9, 29
Y	the whole document	12
X	US 2 881 619 A (R.J. FOX ET AL) 14 April 1959 (1959-04-14) column 2, line 15 - line 43; figures 1-3	1, 7, 8, 29, 30
X	US 2 953 934 A (E.V. SUNDT) 27 September 1960 (1960-09-27) column 2, line 40 - column 3, line 72; figures 2-5	1, 7, 8, 29
Y	EP 0 448 515 A (SOCIÉTÉ INDUSTRIELLE DE SONCEBOZ S.A.) 25 September 1991 (1991-09-25) abstract; figure	12

☐ Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

## \* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

13 July 2000

Date of mailing of the international search report

20/07/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Mende, H

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/NL 00/00227

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 19736503 A	25-02-1999	DE 19881217 D WO 9910662 A	13-07-2000 04-03-1999
US 2881619 A	14-04-1959	GB 851925 A	
US 2953934 A	27-09-1960	NONE	
EP 448515 A	25-09-1991	NONE	

## PATENT COOPERATION TREATY

INGFF. 21 MEI 2001

From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

To:

JORRITSMA, Ruurd et al  
 NEDERLANDSCH OCTROOIBUREAU  
 Postbus 29720  
 Scheveningseweg 82  
 NL-2502 LS The Hague  
 PAYS-BAS

International Preliminary Examination Report	17-6-01
Notification of Transmittal of the International Preliminary Examination Report	6-10-01

NOTIFICATION OF TRANSMITTAL OF  
 THE INTERNATIONAL PRELIMINARY  
 EXAMINATION REPORT  
 (PCT Rule 71.1)

Date of mailing  
 (day/month/year)

17.05.2001

Applicant's or agent's file reference  
 BO 42487 Web

## IMPORTANT NOTIFICATION

International application No.  
 PCT/NL00/00227

International filing date (day/month/year)  
 06/04/2000

Priority date (day/month/year)  
 06/04/1999

Applicant

SKF ENGINEERING &amp; RESEARCH CENTRE B.V. et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.
4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/

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 Tel. +49 89 2399 - 0 Tx: 523656 epmu d  
 Fax: +49 89 2399 - 4465

Authorized officer

Reiff, U

Tel. +49 89 2399-8070







## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference <b>BO 42487 Web</b>		<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. <b>PCT/NL00/00227</b>		International filing date (day/month/year) <b>06/04/2000</b>	Priority date (day/month/year) <b>06/04/1999</b>
International Patent Classification (IPC) or national classification and IPC <b>F16H25/22</b>			
Applicant <b>SKF ENGINEERING &amp; RESEARCH CENTRE B.V. et al.</b>			
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 5 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 5 sheets.</p>			
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"><li>I <input checked="" type="checkbox"/> Basis of the report</li><li>II <input type="checkbox"/> Priority</li><li>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</li><li>IV <input type="checkbox"/> Lack of unity of invention</li><li>V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</li><li>VI <input type="checkbox"/> Certain documents cited</li><li>VII <input checked="" type="checkbox"/> Certain defects in the international application</li><li>VIII <input type="checkbox"/> Certain observations on the international application</li></ul>			
Date of submission of the demand  <b>03/11/2000</b>		Date of completion of this report  <b>17.05.2001</b>	
Name and mailing address of the international preliminary examining authority:   <b>European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4485</b>		Authorized officer  <b>E.J. Stierman</b>  Telephone No. <b>+49 89 2399 8883</b> 	

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**International application No. **PCT/NL00/00227****I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17):*)

**Description, pages:**

1-5 as originally filed

**Claims, No.:**

1-15 as received on 06/04/2001 with letter of 06/04/2001

**Drawings, sheets:**

1/2,2/2 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☒ the claims, Nos.: 16-33

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**International application No. **PCT/NL00/00227**☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):  
*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability;  
citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes:	Claims	1-15
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-15
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-15
	No:	Claims	

2. Citations and explanations  
**see separate sheet**

**VII. Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:  
**see separate sheet**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/NL00/00227

Reference is made to the following document:

D1: DE 19736503

**Re Item V**

**Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

The invention relates to an actuator to convert a rotary movement into a linear translation comprising a housing, a motor, a screw and nut mechanism and a gear reduction mechanism.

A similar actuator is known from D1.

It is an object of the invention to design an actuator with compact dimensions.

This object is according to the characterizing portion of claim 1 solved in that the gear ring of the reduction mechanism is integrated with the screw of the screw and nut mechanism. (In D1 the gear ring of the reduction mechanism is integrally connected to the nut instead of to the screw. Although the invention seems a trivial alternative constructional measure, it cannot be derived from D1 because it would also involve an alternative construction of non-rotatably connecting the nut to the housing.)

Hence, this alternative is neither known from, nor rendered obvious by the available prior art. The subject-matter of claim 1 is therefore new and inventive; claim 1 fulfills the requirements of Article 33 PCT. Claims 2-15 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/NL00/00227

**Re Item VII****Certain defects in the international application**

Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the document D1 is not mentioned in the description, nor is this document identified therein.

The description is not in conformity with the claims as required by Rule 5.1(a)(iii) PCT. In particular, the embodiment of figure 3 does not form part of the invention.

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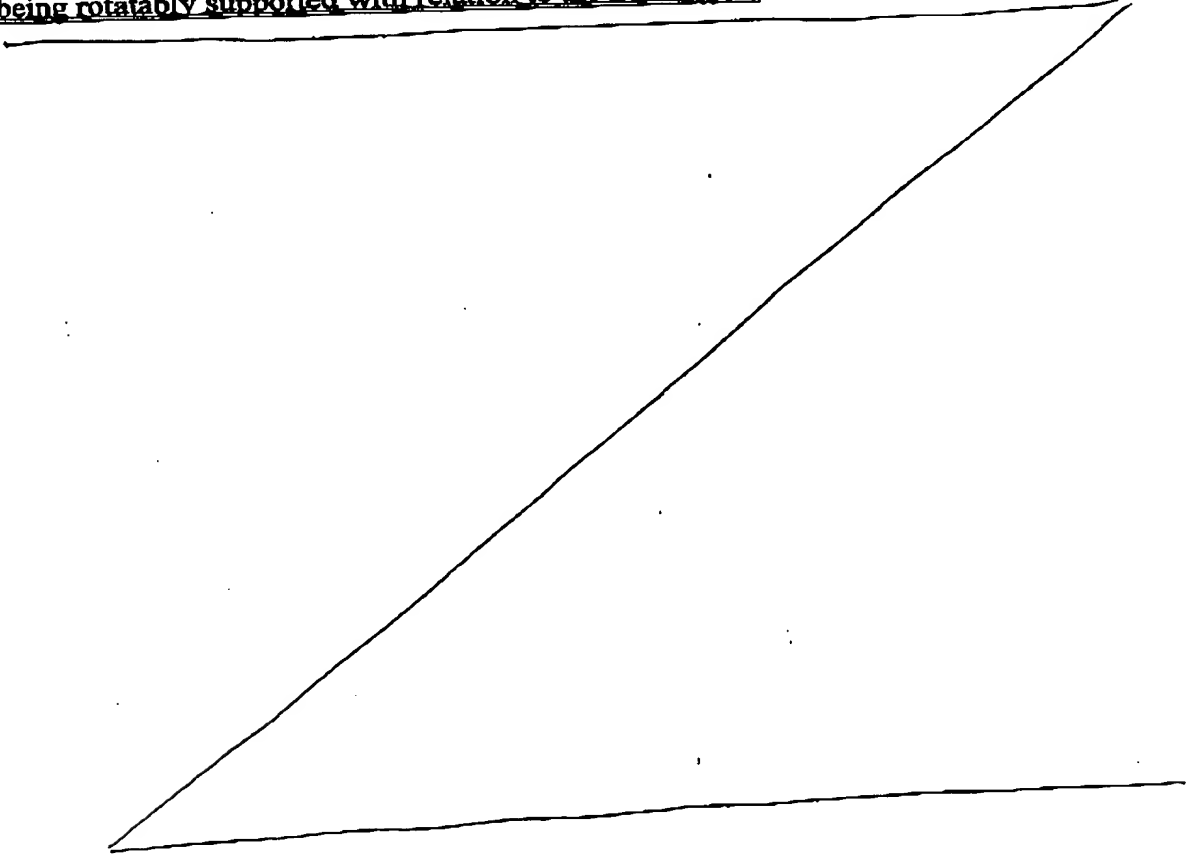
EPO - DG 1

06. 04. 2001

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(75)

Claims

1. Actuator, comprising a housing (1), which contains a motor (2) and a screw  
5 mechanism (3), said screw mechanism (3) comprising a screw (16) and a nut (17) one  
of which is rotatably supported with respect to the housing (1), and a gear reduction  
mechanism (4) connecting the rotor (7) of the motor (2) to the rotatable screw (16) or  
nut (17), said gear reduction mechanism (4) comprising at least a concentric gear ring  
10 having radially outwardly directed teeth wherein the outer diameter of the gear wheel  
(24) is smaller than the inner diameter of the gear ring (25), such that the teeth of said  
gear wheel (24) and gear ring (25) engage each other along a part of their  
circumferences, and at an opposite part of their circumferences are out of engagement,  
said excentric gear wheel (24) being rotatable accommodated on an excentric hub (23)  
15 which is connected to the rotor (7) of the motor (2), characterised in that the gear ring  
(25) is integrated with the screw (16) of the screw mechanism (3), said screw (16)  
being rotatably supported with relation to the housing (1).
- 

AMENDED SHEET

06-04-2001

6<sup>a</sup>Claims

1. Actuator, comprising a housing (1), which contains a motor (2) and a screw mechanism (3), said screw mechanism (3) comprising a screw (16) and a nut (17) one of which is rotatably supported with respect to the housing (1), and a gear reduction mechanism (4) connecting the rotor (7) of the motor (2) to the rotatable screw (16) or nut (17), characterized in that the gear reduction mechanism (4) comprises at least a concentric gear ring (25) with radially inwardly directed teeth, an excentrically positioned gear wheel (24) having radially outwardly directed teeth wherein the outer diameter of the gear wheel (24) is smaller than the inner diameter of the gear ring (25), such that the teeth of said gear wheel (24) and gear ring (25) engage each other along a part of their circumferences, and at an opposite part of their circumferences are out of engagement, said excentric gear wheel (24) being rotatable accommodated on an excentric hub (23) which is connected to the rotor (7) of the motor (2).
2. Actuator according to claim 1, wherein the gear ring (25) is integrated with the screw (16) of the screw mechanism (3), said screw (16) being rotatably supported with relation to the housing (1).
3. Actuator according to claim 1, wherein the rotor (7) of the motor (2) is rotatably supported on the outer ring (10) of a support bearing (11), said outer ring (10) being integrated with the screw (16) and the gear ring (25).
4. Actuator according to claim 3, wherein the rotor (7) by means of a radially inwardly extending flange (21) is connected to the excentric hub (23).
5. Actuator according to claim 4, wherein a positive back-drive mechanism (30) is connected to the flange (21) and the housing (1).
6. Actuator according to claim 5, wherein the positive back-drive mechanism is a spiral spring (30).
7. Actuator according to any of the preceding claims, wherein the excentric gear

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wheel (24) is rotatably supported with respect to the excentric hub (23) by means of a rolling element bearing (30).

7  
8. Actuator according to any of the preceding claims, wherein the motor (2) is  
5 an electric motor, the stator (6) of which is connected to the housing (1).

8  
9. Actuator according to any of the preceding claims, wherein the gear reduction  
mechanisme (4) is at the end of the screw mechanism (3) opposite the end thereof  
engaging an actuating means (38) for a brake pad (39).

10  
9  
10. Actuator according to any of the preceding claims, wherein the screw (16) of  
the screw mechanism (3) is rotatably supported by means of a support bearing (11)  
with respect to a central support shaft (13), the gear ring (23) and the gear wheel (24) of  
the reduction gear mechanism (4) surrounding said central support shaft (13).

15  
10  
11. Actuator according to any of the preceding claims, wherein the screw (16) has  
a bore (35) containing a lubricant reservoir (36).

11  
12. Actuator according to any of the preceding claims, wherein the gear reduction  
20 mechanism (4) and a positive back-drive mechanism (37) are contained in a gear  
reduction module (40).

12  
13. Actuator according to any of the preceding claims, wherein the gear reduction  
module (40) comprises a central support shaft (13) for supporting the screw mechanism  
25 (3).

13  
14. Actuator according to any of the preceding claims, wherein the screw  
mechanism (3), a support bearing (11) for supporting the screw mechanism (3), the  
rotor (7) of the motor (2) as well as a bearing (9) for supporting the rotor (7) on the  
30 screw mechanism (3) are contained in a actuator module (41).

14  
15. Actuator according to any of the preceding claims, wherein the housing (1),



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the stator (6) and electric connections for the motor (2) are contained in a housing module (42).

- 5 16. Actuator according to one claim 1, comprising a housing (55), a nut (55) and a screw (56) one of which is axially fixed with respect to the housing (51) and the other of which is axially displaceable with respect to the housing (51) for moving an actuating head (71), as well as a motor (57) which comprises a stator (58) connected to the housing (51), and a rotor which is drivingly connected to a rotatable part (56) of the screw actuator (54), the housing (51) having a bore (60) accommodating at least the nut (55) and/or screw (56), an axially fixed part (55) of said nut (55) or screw (56) being supported with respect to a radial support abutment (61) which extends inwardly in the bore (60), wherein the rotor (59) of the motor (57) supported rotatably on a sleeve (63), said sleeve (63) engaging the fixed part (55) and extending away from the actuating head (71), said sleeve (63) having a radially outwardly extending sleeve flange (64) which is interposed between said support abutment (61), and the axially fixed part (55).
- 10 17. Actuator according to claim 16, wherein the flange (54) of the sleeve (63) is supported on an abutment surface (62) of the support abutment (61) which faces an actuating head (71) connected to the axially displaceable nut (55) or screw (56) for exerting a compressive force.
- 15 20 18. Actuator according to claim 16 or 17, wherein the nut (55) is fixedly supported within the housing (51), said nut (55) having a radially outwardly extending nut flange (65) facing the outwardly extending sleeve flange (64) and overlapping the inwardly extending support abutment (61).
- 25 19. Actuator according to claim 18, wherein the outwardly facing surfaces of sleeve flange (14) and the nut flange are curved in axial cross section, so as to allow swivelling or tilting of said nut and sleeve due to misalignment forces.
- 30 20. Actuator according to claim 18 or 19, wherein the nut (55) has a nut extension (66) extending beyond the nut flange (65) and inside the support abutment (61), the sleeve (63) having an axially extending support part (67) which is accommodated between said nut extension (66) and the support abutment (61).

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31. Actuator according to claim 30, wherein the gear wheel mechanism (4) is connected to a central drive shaft (76) which is rotatably supported in the housing (51) and which extends into a bore (77) in the screw (76), said drive shaft (76) being non-rotatably coupled to the screw (56) through a spline/groove mechanism.

5

32. Actuator according to claim 31, wherein a lubricant dosing module (79) is accommodated in the bore (60) of the screw (66).

15

33. Brake calliper, comprising a claw piece with at least two brakes, and an

10 actuator according to any of the preceding claims.

**OLIFF & BERRIDGE, PLC**

ATTORNEYS AT LAW

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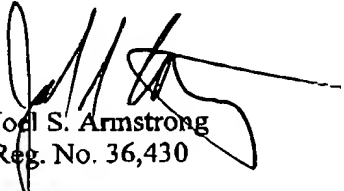
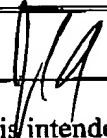
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From: Joel S. ArmstrongYour Ref.: 09/937,776Our Ref.: 110748Number of Pages Sent (Including cover sheet): 12Prepared By: JSA**Comments:**

Ms. Young,

Further to your request, attached is a copy of the International Preliminary Examination Report. Please let me know if you have any further questions.

  
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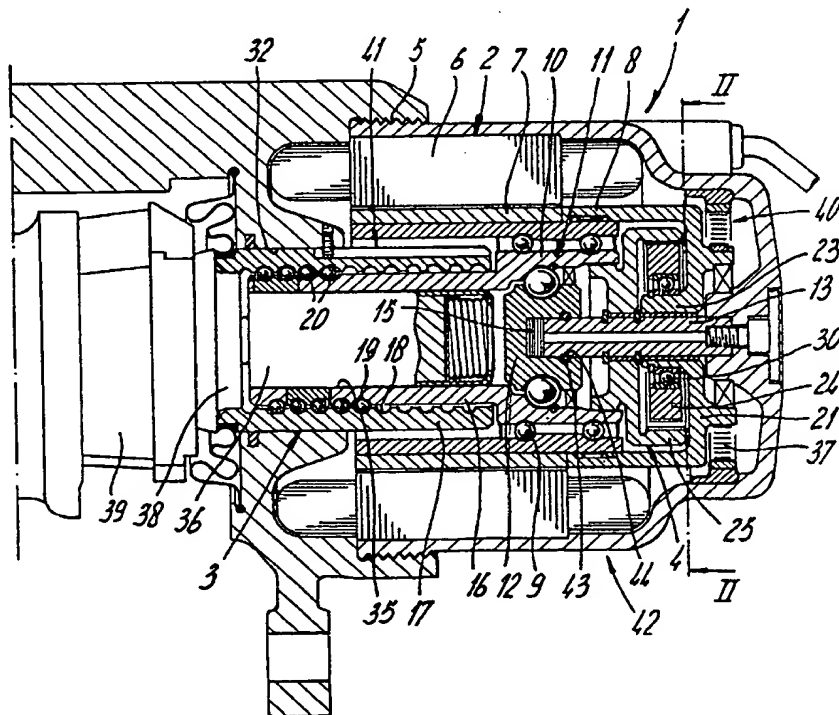


## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>7</sup> :</b> <b>F16H 25/22, F16D 65/21, 65/16</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 00/60255</b> <b>(43) International Publication Date:</b> 12 October 2000 (12.10.00)
<b>(21) International Application Number:</b> PCT/NL00/00227 <b>(22) International Filing Date:</b> 6 April 2000 (06.04.00) <b>(30) Priority Data:</b> 1011731 6 April 1999 (06.04.99) NL <b>(71) Applicant (for all designated States except US):</b> SKF ENGINEERING & RESEARCH CENTRE B.V. [NL/NL]; P.O. Box 2350, NL-3430 DT Nieuwegein (NL). <b>(72) Inventors; and</b> <b>(75) Inventors/Applicants (for US only):</b> <del>KAPPAAN</del> , Hendrikus, Jan [NL/NL]; Waterhoen 5, NL-3435 DM Nieuwegein (NL). <del>ZWARTS</del> , Jacobus [NL/NL]; <del>Carmenlaan 5</del> , NL-3438 VA Nieuwegein (NL). <del>BROERSEN</del> , Simon, Jan [NL/NL]; Lichtegaarde 41, NL-3436 ZS Nieuwegein (NL). <b>(74) Agent:</b> JORRITSMA, Ruurd; Nederlandsch Octrooibureau, Scheveningseweg 82, P.O. Box 29720, NL-2502 LS The Hague (NL).		<b>(81) Designated States:</b> AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).  <b>Published</b> With international search report.

**(54) Title:** ACTUATOR HAVING COMPACT GEAR REDUCTION**(57) Abstract**

A screw actuator comprises a housing (1), a nut (A) and a screw (16) one of which is axially fixed with respect to the housing and the other of which is axially displaceable with respect to the housing for moving an actuating head, as well as a motor (2) which comprises a stator (6) connected to the housing, and a rotor (7). The rotor (7) of the motor is supported rotatably on a sleeve (8), said sleeve has an inwardly directed flange (21), which carries an eccentric hub (23). The eccentric hub (23) rotatably supports a gear wheel (24) through bearing (30), the outer teeth of which gear wheel (24) engage the inwardly directed teeth of the ring gear (25). The ring gear (25) is driving screw (16) which is rotatably supported in the housing (1). The nut (17) of the screw mechanism (4) is slidably, but not rotatably with respect to the housing. Through the screwthreads (18, 19) and balls (20), the rotary motion of the screw (16) is converted into a linear motion of the nut (17), which is contained in a cylinder space (32) in the housing (1).



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# INTERNATIONAL SEARCH REPORT

International Application No

PCT/NL 00/00227

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 F16H25/22 F16D65/21 F16D65/16

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 F16H F16D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 197 36 503 A (SCHAEFFLER WAEZLAGER OHG) 25 February 1999 (1999-02-25)	1,2,7-9, 29
Y	the whole document	12
X	US 2 881 619 A (R.J. FOX ET AL) 14 April 1959 (1959-04-14) column 2, line 15 - line 43; figures 1-3	1,7,8, 29,30
X	US 2 953 934 A (E.V. SUNDT) 27 September 1960 (1960-09-27) column 2, line 40 -column 3, line 72; figures 2-5	1,7,8,29
Y	EP 0 448 515 A (SOCIÉTÉ INDUSTRIELLE DE SONCEBOZ S.A.) 25 September 1991 (1991-09-25) abstract; figure	12



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

### \* Special categories of cited documents :

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Date of the actual completion of the international search

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Date of mailing of the international search report

20/07/2000

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/NL 00/00227

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 19736503 A	25-02-1999	DE 19881217 D WO 9910662 A	13-07-2000 04-03-1999
US 2881619 A	14-04-1959	GB 851925 A	
US 2953934 A	27-09-1960	NONE	
EP 448515 A	25-09-1991	NONE	